

**Study Guide**

For use with pages 419–425

**GOAL** Write linear equations.**VOCABULARY**

Often, there is no single line that passes through all the points in a data set. In such cases, you can find the **best-fitting line**, which is the line that lies as close as possible to the data points.

**EXAMPLE 1** Writing an Equation Given the Slope and y-InterceptWrite an equation of the line with a slope of  $-13$  and a y-intercept of  $19$ .

$$y = mx + b \quad \text{Write general slope-intercept equation.}$$

$$y = -13x + 19 \quad \text{Substitute } -13 \text{ for } m \text{ and } 19 \text{ for } b.$$

**EXAMPLE 2** Writing an Equation of a Graph

Write an equation of the line shown.

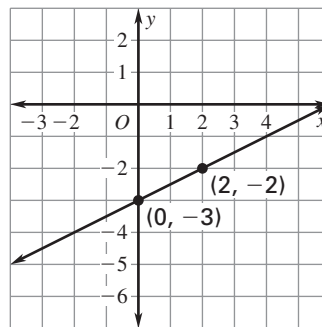
- (1) Find the slope
- $m$
- using the labeled points.

$$m = \frac{-2 - (-3)}{2 - 0} = \frac{1}{2}$$

- (2) Find the y-intercept
- $b$
- . The line crosses the y-axis at
- $(0, -3)$
- , so
- $b = -3$
- .

- (3) Write an equation of the form
- $y = mx + b$
- .

$$y = \frac{1}{2}x - 3$$

**EXAMPLE 3** Writing Equations of Parallel or Perpendicular Lines

- Write an equation of the line that is parallel to the line  $y = -15x + 11$  and passes through the point  $(0, -8)$ .
- Write an equation of the line that is perpendicular to the line  $y = -9x + 6$  and passes through the point  $(0, 1)$ .

**Solution**

- The slope of the given line is  $-15$ , so the slope of the parallel line is also  $-15$ . The parallel line passes through  $(0, -8)$ , so its y-intercept is  $-8$ .

**Answer:** An equation of the line is  $y = -15x + (-8)$ , or  $y = -15x - 8$ .

- Because the slope of the given line is  $-9$ , the slope of the perpendicular line is the negative reciprocal of  $-9$ , or  $\frac{1}{9}$ . The perpendicular line passes through  $(0, 1)$ , so its y-intercept is  $1$ .

**Answer:** An equation of the line is  $y = \frac{1}{9}x + 1$ .

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**EXAMPLE 4** Approximating a Best-Fitting Line

The table shows the average daily cost to community hospitals per patient for the years 1994–2000.

Years since 1994, $x$	0	1	2	3	4	5	6
Average daily cost	\$931	\$968	\$1006	\$1033	\$1067	\$1103	\$1149

- Approximate the equation of the best-fitting line for the data.
- Predict the average daily cost per patient in 2004.

**Solution**

- First*, make a scatter plot of the data pairs.

*Next*, draw the line that appears to best fit the data points. There should be about the same number of points above the line as below it. The line does not have to pass through any of the data points.

*Finally*, write an equation of the line. To find the slope, estimate the coordinates of two points on the line, such as (0, 931) and (2, 1001).

$$m = \frac{1001 - 931}{2 - 0} = \frac{70}{2} = 35$$

The line intersects the  $y$ -axis at (0, 931), so the  $y$ -intercept is 931.

**Answer:** An approximate equation of the best-fitting line is  $y = 35x + 931$ .

- Note that  $2004 - 1994 = 10$ , so 2004 is 10 years after 1994.

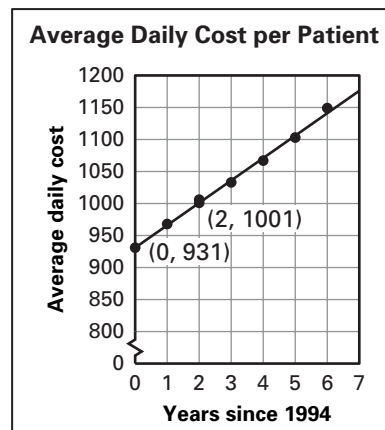
Calculate  $y$  when  $x = 10$  using the equation from part (a).

$$y = 35x + 931 \quad \text{Write equation of best-fitting line.}$$

$$y = 35(10) + 931 \quad \text{Substitute 10 for } x.$$

$$y = 1281 \quad \text{Simplify.}$$

**Answer:** In 2004, the average daily cost per patient will be about \$1281.

**Exercises for Examples 1–4**

Write an equation of the line with the given characteristics.

- slope = 7;  $y$ -intercept =  $-8$
- passes through the points (0,  $-4$ ) and ( $-7$ , 1)
- perpendicular to the line  $y = \frac{8}{3}x - 5$ ; passes through the point (0, 4)
- Write the equation of the line that appears to best fit the data points. Use it to predict the value of  $y$  when  $x = -9$ .

$x$	-3	-2	-1	2	4	5
$y$	-2	-3	-2	0	1	2